Continuous Feedback Pedagogical Patterns

Kathleen A. Larson
Mount Saint Mary College
Newburgh, New York
klar3418@my.msmc.edu

Frances P. Trees
Drew University
Madison, New Jersey
ftrees@drew.edu

D. Scott Weaver
Messiah College
Grantham, Pennsylvania
sweaver@messiah.edu

ABSTRACT

Successful teachers recognize there is more to teaching than mastering content. Concern for student learning is the central theme. Over time, teachers develop a repertoire of best practices, classroom skills, and methods that have proven effective for them. The teaching patterns presented here were gathered from our collective experience in the classroom and those we have observed among our colleagues. The patterns presented in this paper focus on continuous feedback. Some patterns involve direct feedback from the teacher to the student while others involve feedback from the students to the teacher. Several of the patterns can be adapted for use in classrooms ranging from kindergarten to adult learning and to seminars and workshops in the business and industrial communities.

Categories and Subject Descriptors

K.3.2 [**Computers and Education**]: Computer and Information Science Education—*Computer Science Education*

General Terms

Management, Human Factors

Keywords

Patterns, Education, Feedback

1. INTRODUCTION

Successful teachers recognize there is more to teaching than mastering content. Content can be learned. Although mastering the subject content is necessary, it is not sufficient for success as a teacher. Teaching requires massive amounts of planning, careful attention to learning styles, design of authentic assessment tools, and continuous self-evaluation of the success of each lesson. Concern for student learning is the central theme. Over time, teachers develop a repertoire of best practices, classroom skills, and methods that have proven effective for them. Successful teachers are passionate about their subject and their profession. This passion is nourished by the sharing among peers of successful teaching techniques.

The teaching patterns presented here were gathered from our collective experience in the classroom and those we have observed among our colleagues. Several of these patterns can be adapted for use in any classroom, from primary grades through adult education. For very young children, the teacher has the added task of actually teaching the children the mechanics of the pattern, keeping everything very simple, demonstrating what she expects, walking the students through the process, and gradually teaching them how to work cooperatively with each other. One goal of a successful teacher is to develop an environment of trust and collaboration in which students feel comfortable and confident enough to actively participate. The patterns presented in this paper focus on continuous feedback. Some patterns involve direct feedback from the teacher to the student while other patterns involve feedback from the students to the teacher. These patterns complement the Feedback Patterns and Active Learning Patterns described in the current work of the Pedagogical Patterns Community [1].

2. OVERVIEW OF CONTINUOUS FEEDBACK PATTERNS

- **Learning Contract**: Require students to be responsible for their own learning.
- **Minimum Distance**: Teach from all parts of the classroom rather than being glued to the front.
- **Carefully Crafted Questions**: Carefully construct questions to accompany lessons.
- **Simple Answer**: Construct easily answered questions to build student confidence.
- **Open Ended Questions**: Construct questions to activate higher level thinking.
- **Think...Pair...Share**: Allow students time to formulate an answer, talk it over with another student, and then present their considered response to the class.
- **Pregnant Pause**: Allow students time to digest a question and respond.
- **Uninterrupted Listening**: Allow students time to complete a response rather than finishing statements for them.
- **Three Stars and a Wish**: Find three positive things

to say about student work before giving a criticism.

- **Hands Free Help**: Help students solve a problem but don't do it for them.
- **Line of Reasoning**: Allow for unexpected responses and investigate student thought processes.
- **Honest Appraisal**: Periodically collect student journals reflecting on what they have learned during the time period.
- **Piece of Mind**: Provide students an opportunity to anonymously give you feedback.

Although these patterns focus on an educational environment, many of them are applicable to any situation where feedback is involved. For example, your colleague successfully uses a technique to increase active participation in his university classroom. You realize that you can employ this same technique in conducting a meeting of your local service organization or in your business. Ideally, many of the patterns we present in this paper will have applications beyond that of the classroom environment.

3. LEARNING CONTRACT

Students take responsibility for their own learning.

3.1 Problem

Students do not accept responsibility for their own learning and tend to hold the teacher or other external factors accountable for a low grade.

3.2 Context

On the first day of a college (and possibly secondary school) class students are given a copy of the course syllabus.

3.3 Forces

Students don't view the course syllabus as an important document. A few may read the whole document, but many students look only at the schedule and grading scale. If the teacher goes over the document in class, they tune out. Teachers need their students to read the syllabus so the students are aware of their responsibilities as learners. Students need to read the syllabus so they understand their teacher's expectations. When the course ends, students who have not read the syllabus often blame the teacher for a poor grade.

The teacher expects the students to understand the course objectives and their responsibilities as stated in the syllabus.

3.4 Solution

When the course syllabus is handed out, tell the students to read it carefully. Go over the course outline, the list of assignments, and the grading scale, explaining that the syllabus represents your promise to them. Tell the students to think of the syllabus as a contract. Say "My part of the contract is to deliver this course content to you to the best of my ability. This is my half of our contract." Tell them before the next class they are to write their half of the contract, their promise to you. This learning contract should include the grade the student wants to earn in the course and exactly what s/he will do to earn that grade, responding to each item in the syllabus point by point. Provide a template as a guideline for students to follow. Refer to the learning contract agreement repeatedly during the course.

3.5 Rationale

The learning contract requires students to read the syllabus carefully, becoming aware of course requirements for academics, attendance, behavior, and other expectations you have included. By writing the contract they specify their responsibilities in the learning process.

3.6 Examples

Terri teaches Curriculum Planning and Instruction to prospective teachers in the Education Department of a small college. On the first day of class she hands out a copy of the syllabus, briefly discusses the main points, tells the students what is important to her in assessing their work, and says the syllabus represents her promise, her half of a contract, of what she will deliver to them throughout the course. She then tells the students they are to carefully read the syllabus, decide the grade they plan to achieve, and write a contract to her listing the grade and, point by point, what they will do to achieve it. This is their contract back to Terri. She provides a template and an example of the type of document she expects from her students and tells them the contract is due at the beginning of the next class. Contracts are signed by both parties and copies are given to both.

Nick uses Learning Contract at the beginning of each marking period in his middle school mathematics classroom with those students who need to improve their grade. He meets with the students individually and they write a contract together. The students then take the contract home for parental or guardian signature. Both Nick and the student keep a copy of the contract. They touch base weekly to discuss responsibilities and progress.

The SCUBA store uses classrooms in local business establishments to hold the academic portion of SCUBA classes. Recently, the cost for using these classrooms has risen so much that the owners of the shop have decided to use Learning Contract with students for academic work. The first night of the course, the students, instructors, and shop owners review a contract that outlines the expectations of each group. The student has the responsibility to read the book and watch the videos in an independent study approach. In this way, the instructors meet with the students only to review the homework and administer and review quizzes. Because this face-to-face meeting is much shorter than the original classroom session, it is held in the SCUBA shop with minimal interruptions for the retail SCUBA business. The contract is signed by everyone and everyone is given a copy.

3.7 Consequences

Students are more responsible. They understand your expectations and their role in the learning process. You must also take responsibility for delivering content and taking different learning styles into consideration. Students and teacher work together.

If a good example is not provided, students do not know how to write a contract. They may simply tell you their life story about how they have traditionally worked in other classes or how unfair grading has been. The template provided must not include so much help that they copy your

example without reading the syllabus. The goal is for them to study the syllabus and respond to it in their own words.

At the time of year when the learning contract is assigned, the teacher is very busy setting up the course. Collecting and responding to each student's learning contract is one more time consuming task in the teacher's already packed day. The teacher must believe this assignment will pay dividends in the long run to invest the extra effort required at this time.

Regardless of the importance the teacher places on the learning contract, some students may still treat it as busy work and not understand how a thoughtful response can contribute to a better grade in the course.

4. MINIMUM DISTANCE

Walk around the room and show an interest in what each student is doing to overcome an uninviting physical classroom where students can easily lose focus.

4.1 Problem

A traditional classroom or lecture hall provides a built-in spatial separation between most of the students and the lecturing instructor that can be interpreted by the student as disinterest on the part of the instructor.

4.2 Context

You are in a classroom where there is a board, screen, or podium in the front of the room with rows of desks facing the board, in a lab where computers are situated around the perimeter of the room, or in a lecture hall where students are seated in theater style fixed rows.

4.3 Forces

Students learn when they are engaged in the lesson. Teachers are more aware of those students who actively participate.

Some teachers find security by always standing behind a podium in the front of the classroom and being close only to those sitting in the front seats. There is a limited number of front seats in your classroom. Not all students can sit in the front of the room where they are recognized and called on frequently by the teacher. Students in the back of the room lose focus more easily than those in the front. Students in the front of the room tend to pay attention partly because of the proximity of the teacher. Spatial separation can lead to distracted, unfocused students, classroom management issues, and an unfriendly atmosphere.

4.4 Solution

Move to different parts of the room during instruction. Engage the students by asking Carefully Crafted Questions as you travel around the room. Know what each student is working on. Be human. Make eye contact with each student to confirm to the class that you are interested in what each one is doing.

4.5 Rationale

Communication between two people improves when we are in close physical proximity to the other person. The other person can't ignore us nor remain detached as easily when we are nearby. By being in close proximity of each student, you convey to them that the sense of learning is everywhere in the room, not just in the front of the room.

4.6 Examples

During a computer class, Fran used a projector to view lecture slides on developing a personal web page. The projector was an integrated part of the podium in the front of the room and there was no available remote that could have been used to advance the presentation slides. After advancing each slide, she walked around the room to view the work of several students, walking in different areas of the classroom while she explained the material displayed on the slide. The students were aware that she was making sure that they understood the steps as they were presented on the slides.

One of the best examples of Minimum Distance is the technique used to engage the audience in the Broadway musical "Hair." Before the musical even begins, the actors interact with the audience from theater seats and from the stage. The production breaks the "fourth wall" or spatial separation by bringing actors into the theater and even having them swing on a trapeze above the audience. The cast easily builds a rapport with the audience by interacting with them, dancing in the aisles, standing on the chairs, and talking to individual members of the crowd. This Minimum Distance brings the audience into the play.

4.7 Consequences

A classroom where teachers are interested and aware of what the students are doing contributes to a well-managed classroom where students are engaged in the lesson. Eliminating spatial distance minimizes teacher-student barriers.

Make sure you do not overdo the walking around in the traditional classroom or lecture hall that has blackboards, whiteboards, and presentation computers that are stationary and not uniformly distributed. In these situations, moving around during your lectures can lose visual elements and be more difficult for students to follow.

Some students may feel threatened or intimidated when the teacher walks around. They may feel, as do some employees when managers "manage by walking around", that someone is checking up on them. In this case, using Three Stars and a Wish can boost their confidence and alleviate feelings of distrust.

5. CAREFULLY CRAFTED QUESTIONS

Spend time before class preparing questions for your lecture.

5.1 Problem

Instructors often ask questions that fail to achieve the desired goals of the lesson.

5.2 Context

You are in a teaching situation where students are focused on you because you are lecturing or giving instructions. You are ready to introduce a new concept but you want to ensure that previous material has been understood.

5.3 Forces

Not all students readily contribute to class discussions or answer difficult questions about the material presented in class. Some students, because of their personality, will readily participate. Others may be shy or fearful of looking foolish by answering questions incorrectly. Some questions, because of ambiguity, confuse the students making them feel stupid because they do not understand the questions being asked. Students want to answer questions correctly and will hesitate if they are unsure of the intended answer. For the most part, however, students who come to class want to learn.

Your class time is limited and the amount of material you must cover may limit the amount of time you can spend on student interaction.

5.4 Solution

Master the skill of carefully crafting questions. To develop this skill, spend time prior to class constructing Simple Answer and Open Ended Questions whose answers have been discussed in previous classes.

When developing a question, write down all possible answers to that question. Refine the question in such a way that there is one and only one interpretation of the question. Your goal is to make each question unambiguous so that students will feel confident in answering it.

Later in the course, when an atmosphere of trust and participation is evident, craft more thought-provoking questions and use Line of Reasoning to explore alternate approaches in student responses.

5.5 Rationale

The time spent preparing questions prior to class will develop your skill of carefully crafting questions. The more questions a teacher crafts, the better s/he will become at developing good questions. Mastering this skill will result in the ability to successfully craft good questions during the class.

Students keep focused when they are actively involved in the class. Good questioning techniques help to develop an atmosphere of active participation and help students develop a better understanding of the course material.

5.6 Examples

In a programming class the topic of discussion was the difference between classes and objects. Prior to the class, Scott sat down and developed some Simple Answer questions to be used in the class. "Looking around the room we see lots of 'things'. If I choose one, is it a class or an object? Susan for example, is she a class or an object?" The correct answer would be, "Object." Scott wrote the follow up, "Right, she's an object. How do we reference her?" He made a note that the correct answer would be, "By her name, Susan." As Scott reflected on those Simple Answer questions, he realized that the initial question may cause problems within the class. Calling Susan an object isn't flattering and may be offensive. It's okay to say, "HMMM, that didn't come out how I wanted, let me start over [10]." He decided to change the question and reference a book instead of a student. The questions that followed used the book instead of Susan.

Mike sells advertisements. He knows that if he can get the clients to participate in his presentations, he will have better success. Prior to any presentation, he develops questions he knows the clients can answer based on their business. His sales have increased because he uses Carefully Crafted Questions.

The Math Department was hiring a new person for a tenure-track position. One hundred applications were reduced to eight. These eight candidates would be interviewed over the phone and the top three would be invited to an on-campus interview. The phone conversation was limited to 20 minutes for each candidate. The department members spent time prior to the phone interviews constructing a list of Carefully Crafted Questions that would help reveal the candidate's strengths and weaknesses and that would give the candidate a better understanding of the department's expectations.

5.7 Consequences

Asking good, well-planned questions in class gives the students an opportunity to participate and receive immediate feedback. They are encouraged to take an active role in the class. The teacher is prepared and as the questions are asked, receives a better understanding of what the students are learning.

However, students may answer the questions incorrectly. During those situations it is important to appreciate the student's attempt to answer while gently indicating the answer is incorrect. In this situation, the teacher may also find that the students do not understand the material and the presentation may have to change to accommodate them.

6. SIMPLE ANSWER

When students are actively engaged in a class, they are more likely to learn the material. Design some questions to have a simple answer to draw out student response.

6.1 Problem

The instructor is not getting immediate verbal feedback from the students during a lesson.

6.2 Context

You are in a teaching situation where students are focused on you because you are lecturing or giving instructions. You are ready to introduce a new concept but you want to make sure that the previous material has been understood.

6.3 Forces

Your goal is getting students involved in discussions. You aim to develop a classroom atmosphere that fosters trust and encourages participation. For a variety of reasons, students avoid contributing to the class discussion or answering questions. Some students lack confidence in their understanding and would rather keep silent than answer a question with an incorrect response.

Many students desire a class that is dynamic in which they can participate and learn. They usually enter a class timidly, self-conscious of how they come across. With a lack of confidence, they do not contribute and cause the class to be

quiet and lethargic. The energy you bring to the class does little to raise the energy level of the entire class.

6.4 Solution

Ask a series of simple, "close-ended" questions to engage students in the lesson. Start with questions that are simple and whose answers can be easily determined from material you have just covered in class. Use Pregnant Pause to allow students time to answer. Ask these questions continuously throughout your lesson. Think of this as a first step toward increased student involvement.

If students are still not participating, examine the questions you are asking. Take time with your Carefully Crafted Questions and master the skill of asking good questions.

Further steps can be cultivated with Simple Answer, followed by Open Ended Questions, as long as you continue to apply Carefully Crafted Questions. If you utilize these patterns and still find it difficult to engage students, try using Pregnant Pause or Piece of Mind.

6.5 Rationale

Though this may seem like a "regurgitation" of material at the lowest level of thinking, you are fostering an environment of confidence and participation. Students keep focused when they are engaged in the class. Simply listening does not constitute active learning. Students' minds tend to wander when all they do is listen while you talk. An atmosphere of trust and participation develops when you actively involve students. When students are able to positively interact, a level of confidence is developed that will lead to more active learning and more interaction.

6.6 Examples

Angela was teaching students in a programming class to write a counting loop. She first asked, "What do you do repeatedly throughout your day?" She followed that up with asking them how many times they repeat that task. As she continued with the lesson, she chose one of their repetitious tasks, juggling a soccer ball. She then asked them to name the variable we will use for counting. She asked if it would be appropriate to start counting at 15. None of the students agreed with that. "That would be cheating," one replied. So Angela told them their counting variable will be assigned an initial value of zero. Angela continued in this fashion, using Simple Answer to draw students into the lecture. She encouraged everyone to respond and gave "happy" feedback to each student who answered a question. She smiled as she saw other students with their hands in the air and acknowledged them with positive reinforcement by saying, "Is that what you were going to say?"

Todd was explaining how to play a new game in his seventh grade Physical Education class. He knew that the students wanted to start playing before they heard all the rules of the game. To keep them engaged and listening, he often asked simple answer questions about the rules he just finished explaining. He noticed that, although they still wanted to start playing, they continued listening to the rules until he was finished. Their game was more exciting and less argumentative because of Todd's use of Simple Answer.

Paul introduces students to confidence intervals and hypothesis testing for statistical problems by creating step-by-step questions that lead them through the solution's complexity.

6.7 Consequences

Students in your classroom are actively engaged and willing to risk involvement in class discussions. As they experience positive feedback from you, even when an answer isn't exactly what you wanted to hear, they will be more likely to continue to express their thoughts. Moreover, there will be improvement in student understanding and retention rate of course material as well as an increase in the energy level in the class.

Because the answers are simple, students may tend to shout out the answers. You want them to participate, but you also want to give as many students an opportunity to participate as you can.

Too many questions that have simple answers may patronize students causing the opposite reaction. Some students may interpret these questions as below their level of intelligence and may quit interacting altogether.

7. OPEN ENDED QUESTIONS

Prior to class, develop a set of "open-ended" questions, questions that require a full, meaningful answer using the student's previously acquired knowledge and/or feelings.

7.1 Problem

Students fail to demonstrate higher level thinking skills during class.

7.2 Context

You are teaching a class of students with whom you have developed an environment of participation using Simple Answer. You are entering the class with something you want to communicate to your students. The students may have experiences that relate in some way to the subject of your lesson.

7.3 Forces

Some students feel safe in answering questions that relate directly to the material just presented.

Students come to class with varied experiences and rich opportunities to connect what you are teaching with those experiences. Students seldom reflect on what is being communicated with what they have experienced and need a little help in making those connections.

You want to include student experiences as part of the lesson, giving their experiences validity.

7.4 Solution

In order to generate more thorough student responses, a different type of Carefully Crafted Questions is required. Prior to class, develop a set of "open-ended" questions, questions that require a full, meaningful answer using the student's previously acquired knowledge and/or feelings. Start with simple, open-ended questions and if the students respond well, follow that with more challenging, thought-provoking

questions. Use Line of Reasoning to encourage alternate responses.

As your Carefully Crafted Questions include more Open Ended Questions, your Open Ended Questions will become easier to develop and you will be able to craft these types of questions during class.

7.5 Rationale

Learning is about the student connecting concepts with ideas and truths he has already learned. In a classroom lecture when participation is limited or non-existent, the student has no way of externalizing the process and no one to validate the connections. It is important to have students express what they are learning externally so that you can validate these connections for them.

Having students answer questions related to the material just presented is learning because it has engaged the student. However, simply parroting a reply that they have already heard is far from higher levels of thinking or learning.

7.6 Examples

In David's programming class, students had been responding well. They had been actively involved in the class answering David's Simple Answer questions. David knew they understood the basic difference between a class and an object but wanted them to be able to articulate the difference. So, prior to class David used Carefully Crafted Questions, and came up with the follow-up question, "Explain the difference between a class and an object?" He decided to use Pregnant Pause after posing the question to give students an opportunity to think and develop a response.

Scott, a training consultant, has had difficulties getting the adults in his classes to participate. He spent time using Carefully Crafted Questions to develop good questions for Simple Answer and began using this in his classes. He found the adult learners responding more and more as he used this type of questioning along with Pregnant Pause. He then attempted to draw on their experiences so developed Open Ended Questions to use during his class. He found that several students had experiences that related directly with what he was conveying. The students were able to connect the class material to their experiences and other students had the opportunity of learning from their peers.

7.7 Consequences

After using Open Ended Questions and Pregnant Pause, students are given an opportunity to process what they have learned. They are connecting what they've heard with things they already know. When a student gives the correct answer s/he becomes more confident in what s/he knows because of the connections s/he has made.

However, if the open ended question is beyond the student's ability, s/he may become frustrated.

8. THINK...PAIR...SHARE

To introduce a lesson and focus students' attention on the topic, pose a question, allow students a minute or two to *think* about their response, two minutes to *pair* with another student to discuss their responses, and three or four minutes for the partners to *share* one another's responses with the whole class.

8.1 Problem

Students' focus is not on the lesson.

8.2 Context

It's time for class to begin. You might be a primary grades teacher and your students have just arrived in the morning, or they might be returning to the classroom from recess, lunch, or a pull-out program such as art, music, or gym. Alternatively, you might be a secondary school teacher or college professor and class periods have just changed. Perhaps you have been presenting information and realize your students have begun to tune you out.

8.3 Forces

Students' natural inclination is to continue thinking about interests other than the class and to postpone involvement in the lesson. They are in conversation with friends, concerned about personal issues, or planning the rest of their day. Students have reached the limit of their attention span while you've been presenting the lesson. You, on the other hand, have a great deal of knowledge to impart and want their undivided attention.

8.4 Solution

Immediately pose a question that focuses the students' attention on the lesson to be taught. Use Carefully Crafted Questions to engage student participation. Give them time to *think* about the question and write down their answers privately. After one minute tell the students to *pair* with one other person and discuss their answers. After two additional minutes call on members of the class randomly and ask them to *share* with the class their partner's answer. Allow three minutes for sharing, calling on as many members of the class as possible. Ask if other students who did not answer would care to share their partner's response with the class. Then continue with the lesson.

A variation is for each pair to select the better response to the question; another is to combine the two responses into one response to which both partners agree.

8.5 Rationale

This activity accomplishes four goals for the beginning of a lesson. The *think* part grabs the students' attention away from whatever they were thinking about just before class began. It focuses their attention on a question related to the topic of the day, motivating them to learn. Carefully Crafted Questions activates their prior knowledge about the topic, thus improving the probability that the new material will relate to something they already know and will more likely be retained. The pairing part provides an opportunity to practice giving and receiving feedback. The *sharing* part of the activity gives you insight into where the students are coming from and shapes the direction you will take in teaching the lesson. This is diagnostic assessment and is crucial to the effective teaching of the lesson.

Think...Pair...Share can also be used during the course of instruction to focus students' attention on an aspect of the lesson. This allows you to perform formative (ongoing) as-

sessment and modify the lesson to meet student needs and learning styles.

This pattern can also be used to break up the presentation of new material into segments of ten or fewer minutes in length, allowing time for students to assimilate the new information and refocus their attention on the topic if their thoughts have begun to drift away.

8.6 Examples

Allison wanted to introduce a unit about *Ethan Frome* to her tenth grade English Language Arts class. She decided one focus of the novel is Ethan's desire for various things, so at the beginning of class she wrote the word "desire" on the board. She asked her students to take a moment to jot down one time when they desired something and didn't get it and one time when they desired something and did get it. After a minute or two she instructed the students to pair with a student near them and tell each other the events they remembered. She allowed them two minutes and then called on pairs randomly to share one another's desires with the whole class. After this she told the class they were going to study a story about one man's desires and what happened to him.

John uses Think...Pair...Share when he wants to pause in a lecture and provide time for students to assimilate new material. This breaks up the lecture and provides feedback about student learning. John paused during a slide presentation on the forces that caused the United States to enter World War II and asked his eleventh grade American History students to jot down one parallel force they think led to United States involvement in the current conflict in the Middle East. After a minute the students paired to discuss their responses. Then each pair joined another pair and the group was given two minutes to select one contributing factor among those discussed. Each group shared their choice and why it was selected with the class. John helped them relate their responses to the lesson on the slides and to factors that, in general, contribute to a country going to war. He then continued the slide presentation.

Pam has found Think...Pair...Share to be effective when she presents training workshops to adults in the working community. She uses this pattern with business, industry, and community groups.

8.7 Consequences

When practices such as this are a regular part of the lesson, students come to class expecting to become involved immediately. The tone for the class is set. Students expect to interact with one another and with you, the instructor. They believe you are interested in their learning and they become eager learners. Think...Pair...Share results in more effective teaching and learning.

This exercise takes several minutes. In a traditional 45 minute class period, teachers worry about any activity that uses up several minutes of the time needed to present new material. There is a time trade-off but it may result in increased student learning.

Students may also use the share time for conversations about other topics unrelated to the question. However, since you have explained to the class that you expect each pair to be ready to share, call on those who seem to have been discussing other things. After using this pattern often, students realize they do need to be ready to give an answer after the few minutes of pair time.

Some students are uncomfortable speaking out in large groups.

Some students resist partnering with certain other students.

9. PREGNANT PAUSE

Wait long enough for students to think about a question and formulate an answer before continuing with a lesson.

9.1 Problem

Teachers and lecturers ask questions of their audience yet do not give them time to formulate a response.

9.2 Context

You have developed a lesson you want to communicate to students. Your students are generally quiet. You want to ask higher level questions to get your students to think about the subject matter.

9.3 Forces

You are using Carefully Crafted Questions, Simple Answer and/or Open Ended Questions, allowing the students to participate. However, no one in the class is eager to respond. You ask a question and you're met with silence. When you pose a question, no one is quick to answer.

In many classes, students are reluctant to jump at answering your questions. Students may not want to appear to be a "teacher's pet" or a "know it all" and are concerned that showing eagerness to answer questions will label them as such. The questions may be perceived as too difficult by students unaccustomed to applying higher level thinking skills.

You feel the need to fill the silence and have the very strong urge to give the answer to the question yourself. It feels awkward having dead air. You also have a limited amount of time to present your material and engage the students.

9.4 Solution

Silently wait an uncomfortable amount of time (like counting to sixty) before calling on a student for an answer. This allows silent time during which all students have an opportunity to formulate a response. This also causes some discomfort on the part of some students, which may be a good thing. It puts all students in a position of participating.

If you wait and nothing happens, use Minimum Distance and another similar Simple Answer question or a prompt and hint such as "You might want to think about..." to promote participation.

9.5 Rationale

Students need time to think about the question and put it into the context of what they know. They need time to formulate an answer before they volunteer. It is human nature

to feel awkward when there is a silence that is unexpected. This is true with both teachers and students. When that tension is felt, someone will fill the void. Unfortunately, too often it is the teacher rather than the student. Forcing yourself to wait a longer period of time will give the students the opportunity to fill the void.

9.6 Examples

In David's programming class, students had been responding well. They had been actively involved in the class answering David's Simple Answer questions and understood the basic difference between a class and an object. David developed the follow-up Open Ended Questions question, "Explain the difference between a class and an object?" and decided to use Pregnant Pause after posing the question, giving the students an opportunity to think and develop a response. By the time David finished counting to 60, several students had their hands raised, ready to answer his question. David gave each of them an opportunity to give their explanation, finding something positive in each, based on Three Stars and a Wish, on which to commend them.

In thinking about his previous presentations, John realized no one answered the questions he asked. He was tight on time and hadn't waited for responses. When preparing his next lesson, David made sure he would have time to wait for replies. During the next class, when he asked a question, he began silently counting in his head. He counted to 48 before someone responded. After that first question, however, his count became shorter for subsequent questions since the attendees realized he expected a response and would wait for one.

9.7 Consequences

The students who answered had ample time to contemplate the question and came up with correct, insightful answers in their own words and their own contexts.

Sometimes, however, you may have students that are completely off the mark. You can't allow their answer to confuse the other students, so you have to indicate the answer is wrong. However, you want to encourage the student for participating and trying.

Other times, students will call out answers that are wrong. These, too, need to be addressed so that students do not get the impression that the wrong answer may be valid.

Using Pregnant Pause can take a lot of time. This may become a value judgment for you.

10. UNINTERRUPTED LISTENING

Listen to student responses without interruption.

10.1 Problem

The teacher assumes what the student is going to say and interrupts, not allowing the student to complete his or her thought.

10.2 Context

You are teaching a course in which students are encouraged to participate in class discussions, ask questions, and volunteer responses.

10.3 Forces

Students need time to formulate and express their thoughts. You are sometimes impatient when students are providing answers to questions or contributing to discussions.

When a student begins an answer to your question, you want to interrupt and complete the thought for the student because you are in agreement and you think you can anticipate what the student is about to say.

When you interrupt a student, the student assumes that you are interrupting to correct his or her answer. Some students may feel belittled or humiliated when interrupted which can result with fewer, if any, contributions from the student.

You know the student's answer is off track and you are anxious to discuss the correct solution with the class.

When interrupted, students may be either too polite or too intimidated by your expertise and authority to continue their thoughts even if their responses differ from the way you completed the sentence they started.

Sometimes the student has insight. Wait and listen to the student's entire response.

10.4 Solution

When a student is speaking, allow that student to complete his or her response. Follow up with Three Stars and a Wish or Line of Reasoning. Listen to all students with an equal amount of interest and solicit responses. Give your feedback to the student at appropriate times, not in the middle of the student's thought but rather when the student has completed his response.

10.5 Rationale

It is rude to interrupt someone who is speaking. Interrupting students when the students are contributing to a class discussion or answering a question can make the students feel that their responses need to be interpreted or clarified. Respect should be mutual. As the teacher, you usually do not tolerate students interrupting you. Students should be treated with the same respect you expect from them. Given time to think as they respond, your students are better able to define what they are trying to say. Although the start of a student response may not say much, once the student continues with an explanation, the meaning may become clear. Jumping in before the students finish may rob them of the full benefit of externalizing their connection to the lesson and shortchange their learning. In fact, listening to a student's complete response often gives you insight into how your students perceive your lesson. The student's perspective may help you to see your lesson in a different light.

10.6 Examples

Steve asked his Computer Science students to help him write a segment of code to solve a problem. One student started to suggest a very advanced and elegant solution. Steve was so thrilled with the student's response that he was tempted to write the code on the board before (or while) the student was explaining the procedure. He thought about what he was doing, paused, and listened to the entire solution before he wrote the code on the board.

Fran was teaching a computer science class and asked for suggestions for an algorithm for replacing information in a sparse array implementation of a grid. One student began explaining a very elementary and inefficient solution. Although she knew that the student was not on the right track, she allowed the student to complete the suggestion and then used Line of Reasoning to encourage the student to see an alternative, more efficient solution.

10.7 Consequences

Students will understand that their contributions to class discussions are encouraged and valued. They will not fear being cut-off before they finish sharing their thoughts.

This can, however, allow students to drone on and on so that other students lose focus. If this situation occurs more than once, a private conversation with the student may be helpful.

By not interrupting a student's response, community values of mutual respect are reinforced.

11. THREE STARS AND A WISH

When grading assignments, tell each student three things you liked about the work and one "wish" for improvement.

11.1 Problem

You need a way to correct student errors and give feedback without causing your students to become defensive, disheartened, or angry.

11.2 Context

You are grading a student's written paper, oral presentation, or project and you see that there are definite problems that need to be corrected.

11.3 Forces

Some students become discouraged and give up when their errors are pointed out to them. It's difficult to receive negative feedback. What may seem like simple corrections to the teacher may be received as devastating news by the student. When the teacher tells a student there is something wrong with an assignment, the student's ego is deflated and he may become resentful, defensive, or discouraged.

The teacher needs to correct the student but wants to give feedback that will encourage and motivate him to increase his effort.

11.4 Solution

Identify three things you like about the student's work. List those as three stars. Then tell the student "I wish you had done ..." saying what you would like the student to do differently. As difficult as it may seem, you can always find at least one positive thing to say about a student's work and, if you look hard, you'll come up with three.

11.5 Rationale

Giving feedback in a way that will encourage a student to correct the problem and try harder is a challenge. We all want to think when we've invested time and effort into our work that it will be well received. If the teacher first points out three positives about the student's work, hearing one negative isn't as disheartening. At least the teacher found something good to say, and the student accepts the "wish" as advice rather than criticism.

11.6 Examples

Kathleen requires her students to make presentations to the whole class using PowerPoint slides. She has found that many times students are nervous, the slides contain too much text, students read everything directly from the slides, or the information may be questionable. In grading her students, Kathleen makes it a policy to first find three things that were done at least at an acceptable level. For example, the title may have caught the listener's attention, the presentation may have been logically organized, or the slides may have been right on topic. Then she adds a "wish" that the most glaring error the student committed (I wish your slides had not contained so much text) will be corrected. Sometimes Kathleen actually sneaks in multiple errors, couched in language that comes back to the student as a single "wish." (I wish you had written only an outline of your talk on each slide and filled in the text from memory as you talked, so that the slides would have been less crowded and the print large enough for everyone in the room to read.) Students are much more appreciative of criticism in this format than they are of receiving a list of their mistakes.

In grading student journals, Bill compliments his students on using an interesting title, choosing an attractive and readable font, and describing the main topics in recent lessons. Then he adds, "I wish you had reflected more on what these new topics mean to you personally and the relevance of the course as you prepare for your career in ...."

Amy oversees a risk management group in a large investment company. Periodically she must review each member's performance. She studies their accomplishments and when she meets with them she thanks them for their fine effort in three areas before suggesting an area to try to improve.

11.7 Consequences

This solution is especially effective when a student's work is public, either a classroom presentation or work posted on a discussion forum, and all members of the class can use Three Stars and a Wish with the presenter. The stars and wishes will differ from one fellow student to another, so the student in question receives a variety of positive feedback but also hears about several items that need to be corrected.

One difficulty for a teacher occurs when there are several glaring errors. How does the teacher make just one wish? One way around this problem is the procedure described in the paragraph above. Choose the most egregious error for your wish. Encourage everyone in the class to use Three Stars and a Wish with one another, and hope the class points out the errors you chose to overlook. You can also sometimes sneak more than one wish into your response to a student by carefully wording what you say. A third possibility is to wish the student would meet with you to discuss possible misunderstandings about the assignment.

Some students may react to the word "wish" by not making the improvement. The student may say to himself, "Ah,

the teacher didn't require the change. It's only a suggestion." Such an attitude can be discouraged by class discussion about the value of a "wish." Discuss how the wish is a strong suggestion intended to help them turn in their best possible work and earn a better grade on future assignments. Remind them that correcting errors will help them beyond this course.

12. HANDS FREE HELP

When students are having difficulty attacking a problem, assist by offering guidance, not by solving the problem for the student.

12.1 Problem

Students experience difficulties solving problems and want the solution given to them instead of drawing on their past experiences and prior knowledge to solve the problem on their own.

12.2 Context

While you are assisting students during a lab or problem session, you notice that a student stops working because he has no clue as to what to do next. Another student asks for help on a problem and would like you to demonstrate the solution.

12.3 Forces

Students learn more through active participation [6, 4] and they usually want to participate. You want your student to be successful, to finish this problem, and to move on to other problems. The easiest thing to do is to take the keyboard (or pencil) from the student and demonstrate how this problem is done by doing it for the student. If you do all the work and solve all of the problems, the students are deprived from active learning. If you do not help the student, the problem may never be completed.

Some students would rather be done with the problem and would prefer you to complete it for them.

By demonstrating the solution, you may save valuable class time.

12.4 Solution

When students have difficulty solving problems, assist by offering suggestions and advice, not by writing out the solution for the student or taking control of the keyboard.

12.5 Rationale

Students are encouraged to ask questions, seek advice, and work together. If too many answers are given too easily, the student never experiences the struggles that are necessary for success.

12.6 Examples

A student asked for help when he was writing a computer science program. The student did not know how to begin the problem and he was not a great typist. After guiding the student through a few steps and watching the student struggle with keyboard skills, Kathy was very tempted to take the keyboard and type the correct code for the student. Instead, she verbally gave a few hints and asked a few pointed questions to guide the student in the right direction. She told the student that she would return in a few minutes after she answered another student's question. She returned every so often, as promised, to check on the first student's progress and was careful not to leave him with a feeling of abandonment. When needed, she gave this student additional guidance until the student was able to work on his own.

Eli teaches SCUBA diving and was supervising two of his students, a father and his daughter, on their first open water dive. Eli noticed that after the father completed setting up his own SCUBA life support system, he began unpacking and assembling his daughter's equipment. Eli reminded the father to use Hands Free Help so that the daughter would learn and remember how to assemble her own SCUBA gear.

12.7 Consequences

Students learn that the main goal is to solve the problem themselves. Students are active learners and not passive bystanders. Teachers learn patience.

There may be times when you can't find a way to lead the student to the solution without giving them the answer. In that case, discuss the answer and use Line of Reasoning to involve the student in the learning process.

The student will remember more and learn more by doing rather than watching.

13. LINE OF REASONING

Applaud alternative solutions to problems.

13.1 Problem

A student catches you off guard by presenting a solution to a problem or answering a question in a way you didn't anticipate.

13.2 Context

You ask a question or you have a student go to the board to write out a solution to a problem. The student responds in a way that you never considered. You immediately turn to other students looking for the expected response, overlooking or ignoring the first student's answer.

13.3 Forces

You have a set answer in mind and have not considered alternative ways of approaching the question. This can happen with Carefully Crafted Questions. The student answers from another perspective or has a different insight into the question than you had considered.

The student receives negative feedback when his answer isn't given consideration. The student is less likely to risk answering in the future. The rest of the class learns that there is only one right way to solve the problem.

Students come from a variety of backgrounds. When they participate, they do not purposefully answer the question incorrectly. When they step out of their comfort zone to answer a question, they are trying hard to get it right.

13.4 Solution

Give consideration to each student's response. Ask the student to explain his thought process. Take time to analyze the response. Use Pregnant Pause to give the students time to think. Compare and contrast several students' solutions. Praise them for their creative ideas and for seeing the problem from different perspectives.

13.5 Rationale

Sometimes a perfectly good student answer to a question is dismissed because it is not the answer you expected. You fail to recognize that the student's answer might have merit. When this teaching moment occurs, an opportunity to follow the student's line of reasoning is lost.

A classroom where students are free to contribute their ideas and be taken seriously is a classroom where real learning can take place. Students are encouraged to take a risk, to think outside the box, and to verbalize their thought processes.

13.6 Examples

Susanne asked a question that required logical reasoning. She expected to hear deductive solutions but one student offered an inductive solution. She used this student's reasoning to demonstrate the two methods and applaud all the students for using good reasoning skills.

Kathy's statistics quiz contained a question that was easily answered by applying a formula learned in class. One student forgot the formula but reasoned the problem through by using good, gut-level, logical steps. Kathy gave him full credit for his solution and commented that he demonstrated a real understanding of the problem. She asked if he minded sharing this alternate solution with the class.

13.7 Consequences

The classroom models a positive learning environment. Students are encouraged to apply their learning to new situations and to synthesize one concept with others they have studied, moving across disciplines. Teachers and students celebrate new learning. Line of Reasoning can divert you from your lesson plan, taking more time away from your planned activities.

It's hard for teachers to step outside their comfort zone when they are used to knowing all the right answers. Being open to a different point of view can be difficult especially in front of other students.

Admitting that you haven't thought about their proposed solution is sometimes difficult and could be embarrassing.

14. HONEST APPRAISAL

Students periodically submit a journal containing their reflections on what they have learned and how they might apply new learning in their lives.

14.1 Problem

Students don't always make connections between new material and previously learned concepts. They don't take time to think about how this new material might be applicable to their interests and goals.

14.2 Context

You are concerned that your students may learn the material in your lessons in a superficial way.

14.3 Forces

There is pressure on students to get through a course with minimal effort. Students memorize what they think they need to know to pass, not taking time to reflect upon what they are learning. Making connections to what they already know and how to apply the new material to their lives takes effort. Students have the time pressures of other courses, work, family responsibilities, and other obligations.

Teachers want students to reflect upon new learning and consider how they will apply concepts beyond the immediate lesson. Teachers want feedback from students.

14.4 Solution

Have your students submit a reflective journal every two or three weeks in which they review what has been taught, thoughtfully consider what the lessons mean to them, and evaluate the course so far. This journal is not a diary. Rather than listing knowledge learned day by day or copying a summary from the end of a textbook chapter, instruct your students to reflect on course readings, activities, and assignments using higher level thinking skills. You may ask them to begin a sentence with "I believe ..." or "In my judgment ...," requiring them to evaluate what has been learned and apply it to their own situation. Encourage students to include questions they feel were inadequately addressed during class. You may also ask them to identify some aspect of the material studied and connect it to an experience or topic outside the course. If you use Learning Contract, have students reflect on their progress towards their desired grade. Provide students with a copy of the grading rubric prior to assigning the journal. Along with the journal, students submit a self-evaluation using a copy of the rubric. Grade the journals and give each student personal feedback.

14.5 Rationale

The journal encourages students to consider what they have learned over a recent time period. Students activate higher level thinking skills to reflect upon their learning in a meaningful way, accomplishing two main goals. It causes them to relate new learning to prior and future learning. It provides a tool for review of course material, thus helping students to prepare for examinations with a better understanding of course content. Having students self-evaluate according to the rubric ensures they are aware of, and attempt to meet, the criteria.

14.6 Examples

Joan gave her class the following assignment: Write a journal in which you reflect upon the first three weeks of this course. Include substantive reactions to the readings, thoughtful reactions to class discussions and activities, and insightful applications of course content to future goals. Your journal should have a reflective title, thoughtful discussion of major course concepts, and a summary evaluation of the course so far. You will also be graded on an appealing visual presentation, grammar, spelling, and writing style.

Kathy instructs her Introduction to Statistics college students to submit a journal reflecting upon what they have learned throughout a unit of study prior to an examination on the unit. She reminds them to analyze the origin of the formulas introduced in the unit, explain the reasoning of step-by-step solutions, and to write about applying the unit to their particular field of interest. Students write about what they have learned and what they do not yet understand. Kathy returns individual responses, but if there seems to be a common misunderstanding, she corrects this by re-teaching some material prior to the exam.

A group of employees are taking Tara's intense four-week management course applying new data collection and analysis techniques to industry. They are expected to keep a journal and to reflect in writing on what they learned each day and how it applies to their individual role. They also note questions or concerns they have about the day's lessons. The next morning Tara looks over the journals and clarifies misunderstandings.

14.7 Consequences

Students are more aware of the meaning and application of the course to their lives. They are involved in their own learning and do more than memorize facts. They synthesize concepts and connect them to previous learning. This type of journal writing has been successful with students of all ages and in a variety of courses. Even young children can be taught to write very simple reflective journals that help them begin to develop higher level thinking skills.

If graded carefully, journals require many hours of the teacher's time. Having provided a rubric, the teacher must now follow the rubric carefully as she grades. This is a time-consuming process.

Continuous reflection reminds the student of the responsibilities s/he agreed to when using Learning Contract.

Journal writing can be particularly effective for distance learning where the instructor has little knowledge about how students are applying what they learn.

The journal may also give the student perspective on how far s/he has come, helping to avoid discouragement.

15. PIECE OF MIND

Gain insight into your class by having your students anonymously answer the questions "What is helping you right now?" or "What problems are you having?"

15.1 Problem

Students don't readily give feedback regarding their perceived progress in class, the concepts they are struggling with, what they might need to be successful, and/or what has helped them succeed so far.

15.2 Context

You have been teaching a class of students for some time. The presentation style is mostly lecture with students engaged in answering questions about course content.

15.3 Forces

Some students are reluctant to honestly tell you their reactions to the lesson and to your class. They are comfortable answering questions related to the lesson, but are hesitant in offering feedback of a more personal nature. They may fear many things: upsetting you, looking inadequate to their classmates, or even that their grade may be negatively impacted.

You have spent time using Carefully Crafted Questions (Simple Answer and Open Ended Questions) and have used Pregnant Pause consistently. When you try to get feedback of a personal nature such as how students are progressing in your class, what concepts they are struggling with, what might help them better succeed in the class, and/or what has helped them succeed so far, they are reluctant to answer.

In many classes, students are reluctant to ask questions when they lack understanding. Some are hesitant because they believe they will eventually understand the material. Others do not want to appear lost or may not know what questions to ask. Whatever the reason, students who don't stop and ask questions feel lost in the course and don't know how to tell you.

At other times students don't give any indication how they think the course is progressing. They don't freely express their likes or dislikes to you until the final day when course evaluations are given. They may have concerns that you may easily address, making the course better for them, if you were only told.

15.4 Solution

At the end of class, with a couple minutes to spare, hand out an index card to each student. Tell the students not to put their name on the card but to take a couple minutes to write whatever they need you to know. This could be a topic that isn't quite understood, a specific question they would like to ask, or even an "aha" moment they have recently experienced. Encourage every student to be involved by writing anything they want you to know. If they have nothing to say, leave the card blank. Each student should drop a card in the box as they leave the room (whether or not it has anything on it), mixing it with the others to insure anonymity. You should address all questions and concerns during the next class if possible.

15.5 Rationale

You have been teaching a subject for awhile and know the material well. But the hang-ups of one class are not necessarily the same in all classes. It is important for you to understand where your students are in the learning process. What is stumping them at this point may not have stumped other classes.

You need student feedback to better understand where they are, what concepts they may be struggling with, what they think of the class, or even what concept finally clicked with them. This feedback will help you to better design lectures, to steer discussions, and to build a healthy learning environment.

15.6 Examples

Scott brings half-sheets of paper to his programming class. Four minutes before the end of the class, he passes out the half-sheets and explains to the students, "Write on this paper anything you think I need to know. Do not put your name on the paper and drop it off on the front desk when you leave."

One student wrote, "Confused about the object-oriented solution, I need to look over more examples. I don't like things in general terms, confuses me." After reading this, Scott realized he needed to add more examples to his lectures.

Another student complained, "The last project, project 4 has really got me confused. I was fine in the class until the 2nd part of this assignment and then I felt like I didn't know anything. Today helped a lot more. I wish this had happened earlier because I feel like I understand why I have three separate files now. It just seems it came too late." This was discouraging to Scott, since the lecture explained things, but Scott realized this should have been earlier in the semester. He made a note to move this lecture before assigning project 4.

15.7 Consequences

Because of giving students time and an anonymous way of communicating, the teacher is able to understand the problems they are facing. The students are very open about where they are and the frustrations they face. This provides the opportunity to modify subsequent lectures to address the problems they are encountering.

A student may say something you cannot change. For example, "I think that the textbook that we use is really bad." The textbook cannot be changed that semester, but prompts the teacher to re-evaluate the textbook for the next year.

There are other times when student comments contradict one another. For example some comments may indicate that too much time is spent on examples, where other comments indicate that not enough examples are given.

There are times your students give incredible feedback about how helpful the lecture was. One student wrote, "This Fraction class example has been very, very helpful. The explanation and review were refreshing and remind us of what we learned.'

Students can also be harsh. It's difficult to read and respond to some kinds of anonymous feedback.

16. SUMMARY

The Continuous Feedback Patterns introduced in this paper complement the Feedback Patterns [5] and the Active Learning Patterns [8] that are included in the current work of the Pedagogical Patterns Community [7]. The objectives shared by our Continuous Feedback Patterns and the patterns described in the Pedagogical Patterns Project appear below in italics. Our Continuous Feedback Patterns can easily be incorporated into the Quick Access Tables and associated text provided for the Feedback [5] and Active Learning [6] pattern languages. Our goal is to have these patterns included in the larger Pedagogical Patterns Project. There are many objectives shared by our Continuous Feedback Patterns and the patterns described in the Pedagogical Patterns Project:

- All of the Continuous Feedback Patterns are intended to maximize learning by engaging [8].
- Pregnant Pause encourages the teacher to take different skill levels and interests into account [8].
- Carefully Crafted Questions (Simple Answer and Open Ended) are designed to build on the students' past experiences and ensure that the students understand the topic [5, 8].
- Minimum Distance and Three Stars and a Wish are ways to provide feedback that motivate the students [5].
- Hands Free Help and Learning Contract encourage the students to be less dependent on the teacher and helps the student to learn from their own experiences [5].
- Three Stars and a Wish allow for the value of a student's gained knowledge to be visible to the other students [5].
- Piece of Mind gives the teacher insight on the student's perspective of the course and whether the course is useful to the student [5].
- Honest Appraisal, Uninterrupted Listening, Carefully Crafted Questions, and Line of Reasoning ensure the students understand the topic [5].

One common goal of all pedagogical patterns is to provide an insight into successful teaching techniques. Skillful teaching requires two-way communication. Teacher: Do you understand what I'm trying to teach you? Student: This is what I understand about what you've taught me. To borrow from the words of computer scientist Grady Booch, [Teaching] "is incremental and iterative." At each stage both teacher and student need feedback to find out how they're doing.

One could say that these feedback patterns in many ways reflect the Socratic Method of dialogue between teacher and student. Both the teacher and the student are responsible for learning. In our observations and discussions with colleagues and our personal classroom experience we have found these patterns to be key elements to successful teaching — not merely rote learning and memorization but real understanding on the part of our students.

17. AUTHORS

Kathy Larson has been teaching mathematics and computer science more than 30 years in grades ranging from middle school through graduate level. She currently teaches computer science for CIT majors and curriculum development for Education majors at Mount Saint Mary College, Newburgh, New York, and statistics at Marist College, Poughkeepsie, New York. She is particularly interested in implementing computer science curricula in grades K through 12.

Frances P. Trees has been teaching more than 30 years at grade levels ranging from middle school to graduate school and is presently teaching computer science at Drew University in Madison, New Jersey. She works closely with introductory computer science curricula in the high school and university settings and has been actively involved with the Advanced Placement Computer Science Program since 1985.

Scott Weaver has been teaching mathematics and computer

science for over 15 years in grades ranging from middle school to college age. He is currently teaching Computer Science at Messiah College, Grantham, Pennsylvania and is involved in informational sciences curriculum development.

18. ACKNOWLEDGEMENTS

We thank Joe Bergin for encouraging us to share our pedagogical patterns by submitting our work for PLoP consideration. We also thank Mary Lynn Manns, our first shepherd in this journey, and Lise Hvatum, our PLoP shepherd, for their help and support throughout this experience. The group at the PLoP 2008 Writers Workshop provided excellent and very useful suggestions that enabled us to improve our paper in ways that would not have been possible without their valuable contributions.

19. REFERENCES

[1] The Pedagogical Patterns Project. http://www.pedagogicalpatterns.org/.

[2] Dana L. G. Anthony. Patterns for classroom education. pages 391–406, 1996.

[3] Steve Bean. Classroom management to promote learning. http://www.etr.org/recapp/practice/edskills200109.htm, September 2001.

[4] Joe Bergin. Fourteen Pedagogical Patterns. http://csis.pace.edu/~bergin/PedPat1.3.html, July 2000.

[5] Joe Bergin, Jutta Eckstein, Mary Lynn Manns, and Helen Sharp. Feedback patterns. http://www.pedagogicalpatterns.org/, July 2002.

[6] Joseph Bergin. Active learning and feedback patterns: version 4. In *PLoP '06: Proceedings of the 2006 conference on Pattern languages of programs*, pages 1–6, New York, NY, USA, 2006. ACM.

[7] Paul R. Burden, David M. Byrd, and David M. Byrd. *Methods for Effective Teaching: Promoting K-12 Student Understanding*. Pearson, fourth edition, July 2006.

[8] Jutta Eckstein, Joe Bergin, and Helen Sharp. Patterns for Active Learning. In *Proceedings of PLoP 2002*, 2002.

[9] Richard D. Kellough and Noreen G. Kellough. *Secondary School Teaching: A Guide to Methods and Resources*. Pearson, third edition, March 2006.

[10] Charles N. Seashore, Edith Whitfield Seashore, and Gerald M. Weinberg. *What Did You Say?* Bingham House Books, Columbia, MD, 1997.

[11] Harry G Tuttle. Teacher Expectations and Student Achievements (TESA)- Feedback. http://eduwithtechn.wordpress.com/2007/02/25/teacher-expectations-and-student-achievement-tesa-feedback February 2007.

[12] Harry G Tuttle. Teacher Expectations and Student Achievements (TESA)- Giving Student Response Opportunities. http://eduwithtechn.wordpress.com/2007/02/24/teacher-expectations-and-student-achievement-tesa-giving-s February 2007.